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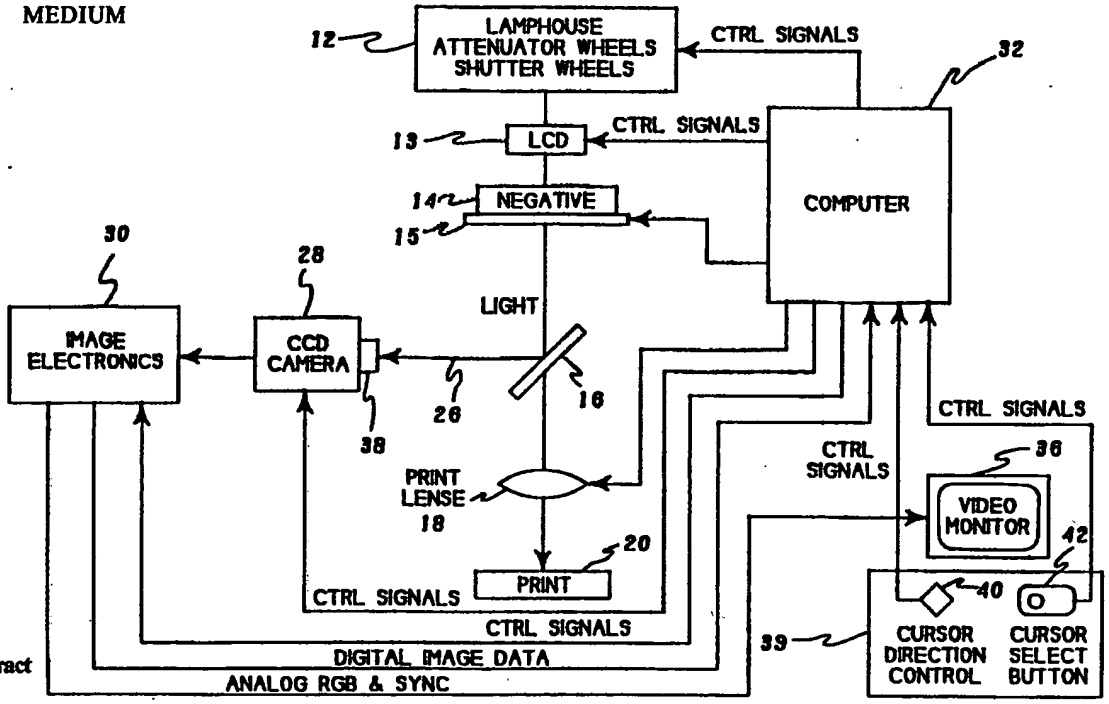

(57) Abstract

A system for regionally varying the exposure of an image onto a photosensitive medium includes projecting light through an LCD display pad having a matrix array of pixels therein and a phototransparency to expose an image onto a photosensitive medium, defining a portion of the image to have exposure levels varied by the LCD display pad, and selectively activating pixels in the LCD pad enabling the exposure level within the defined area of the image to be varied. The system utilizes a means for projecting an image of a phototransparency through an LCD pad onto a photosensitive medium, a means for defining a portion of the image, and a means for selectively activating pixels in the LCD pad to regionally vary the exposure level.

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METHOD AND APPARATUS FOR SELECTIVELY VARYING THE EXPOSURE OF A PHOTOSENSITIVE MEDIUM

Background Art

This invention relates generally to the field of photographic printing and exposure, and more particularly to a method and apparatus for selectively varying the exposure of certain areas of an image printed on a photosensitive medium using a liquid crystal display (LCD) pad.

When printing a photographic negative, it is often desirable to vary the exposure at certain locations of the image to provide a more balanced contrast of densities within the print. Such a technique is typically accomplished by dodging or burning certain areas of the image on the print to either lighten or darken these areas thereby providing the desired contrast of color and balance within the image. Dodging involves limiting the exposure level of a low density or light portion of a negative such that it will not appear too dark in the final print. Conversely, burning involves increasing the exposure level of a high density or dark area of the negative so it will not appear too light in the final print.

These dodging and burning techniques are traditionally accomplished in the photographic laboratory by manually placing a light absorbing medium within the exposure light path. In a situation requiring burning in, where the subject within the image is contained in a high density or dark region of a negative, a person in the lab would manually place a piece of non-transparent material

(cardboard, dark paper, etc.) with an opening therein over the photosensitive medium. The opening is positioned directly over the portion of the image representing the subject to enable the subject to be exposed at a higher level than the remainder of the negative. In a situation requiring dodging, where the subject is located in a low density or light area of the negative, the person in the lab would place a light obstructing medium such as a wand over the portion of the photographic print having the subject thereon thereby preventing overexposure of the subject while allowing the remainder of the image to be exposed to provide a proper balance of contrast.

The problem with this conventional technique is that selectively burning in or dodging areas of the photographic print must be done manually in a dark room on a trial and error basis. The photodeveloper must estimate the amount of burning or dodging necessary to provide a properly balanced print. This typically results in wasting time and resources by conducting multiple attempts to expose a print with a properly balanced contrast. Therefore, the cost of printing photographs and the time involved in producing burned-in or dodged prints are substantially increased over the cost and time involved in conventional photoprinting.

In addition to burning and dodging, vignetting (i.e., the process of exposing images within defined shapes on a photographic print) is also performed manually in a darkroom by physically blocking light from reaching certain locations on the photosensitive medium. For example, producing an image within a heart shaped vignette involves placing a mask having a heart shaped cutout portion

within the exposure light path to allow for exposure of the image in a heart shape. Since vignetting must also be accomplished manually within the laboratory, the time and cost of developing these images on photographic prints is relatively high.

It is therefore an object of the present invention to provide a method and apparatus for regionally varying the exposure of an image on a photosensitive medium by selectively designating regions to be over or under exposed.

It is also an object of the present invention to regionally vary the exposure of images on a photosensitive medium by dodging or burning without the necessity of manually using a mask or wand to limit exposure on certain regions of the photosensitive medium.

It is also an object of the present invention to provide a means for dodging and burning images onto a photosensitive medium using a variable masking means which is integral to the photoprinting apparatus.

It is also an object of the present invention to provide a method and apparatus for vignetting images onto a photosensitive medium.

It is also an object of the present invention to provide a method and apparatus for regionally varying images on a photosensitive medium which may be accomplished outside of the photographic developing laboratory.

It is also an object of the present invention to provide a method and apparatus for regionally varying the exposure of images on a photosensitive medium which may be performed by persons other than skilled photographic technicians or engineers.

Disclosure of Invention

The aforementioned features and advantages of the invention are obtained through implementation of the method and apparatus for regionally varying the exposure of an image according to the present invention.

The method of regionally varying the exposure of an image onto a photosensitive medium includes projecting light through an LCD display pad and a phototransparency to project an image onto a photosensitive medium, the LCD pad has a matrix array of pixels therein defining a portion of the image to have exposure levels varied relative to an undefined portion of the image, and selectively activating pixels within the LCD display pad thereby enabling the areas within the defined portion of the image to be exposed at a different level than the undefined portion of the image.

The method may also include selecting a region of the transparency to be imaged and defining the portion of the image to have exposure levels varied within the selected region of the transparency. The method may further comprise magnifying the selected region of the transparency thereby enabling the defined portion of the image to be a magnified part of the transparency. Pixels within the defined area may be selectively activated, as may be pixels outside of the defined area. Defining the portion of the image may include selecting a predetermined pattern which may be stored in the system's memory or outlining an area on the video display monitor which displays the projected image.

The apparatus for regionally varying the exposure of an image onto a photosensitive medium may include an LCD display pad having a matrix array

of pixels therein, a means for projecting an image of a phototransparency through the LCD display pad onto a photosensitive medium, means for defining a portion of the image representative of an area designated for the purpose of having exposure levels therein varied relative to an undefined portion of the image, and means for selectively activating pixels to regionally vary the exposure levels of the image. The means for selectively activating pixels may be operatively interfaced with the LCD display pad and means for defining a portion of the image.

The apparatus may further comprise a video display monitor operatively interfaced to receive a signal representative of the projected image thereby being capable of displaying the image. Also, a means for selecting a region of the transparency to be projected may be included in the apparatus, and the means for projecting an image of a transparency may be operatively interfaced thereto to enable the means for projecting an image to project only a selected region of the transparency. The apparatus may further comprise a means for magnifying the selected region of the transparency such as a zoom lens. A beam splitter may be included within the apparatus and oriented within the light path generated by the means for projecting an image for splitting the light path and thus creating two identical light path images. The apparatus may further comprise a camera for enabling the image generated from the beam splitter to be displayed on the video display monitor. The camera may also comprise a scanner.

The means for selectively activating the pixels may comprise an exposure control circuit interfaced with the camera, video display and LCD display pad.

The exposure control circuit may include an exposure control computer. The means for defining a portion of the image may include a digitizing means which is capable of designating an outline of an area of the image generated from the transparency. The means for projecting the image of a phototransparency may comprise a lamp house, a transparency support means, and a means for supplying the photosensitive medium, and each of these means may be oriented to allow a light path generated by the lamp house to coincide with the transparency of the support means thereby enabling an image to be projected onto the photosensitive medium.

Brief Description of the Drawings

While the specification concludes with the claims defining the features of the invention that are regarded as novel, it is believed that the invention, together with further objects thereof, will be better understood from consideration of the following description, in conjunction with the drawings in which:

Figure 1 is a block diagram of the photographic printing apparatus constructed in accordance with the present invention;

Figure 2 is a block diagram of the image electronics in the photoprinting apparatus constructed in accordance with the present invention;

Figure 3 is a schematic representation of the photoprinting apparatus in accordance with the present invention excluding electronics, beam splitter, video camera and video display monitor;

Figures 4A, 4B and 4C are a series of drawings depicting a method of selectively varying the exposure of an image onto a photosenstive medium in

accordance with the present invention;

Figure 5 is a drawing depicting an operator console of the apparatus and representative of the technique for defining a portion of the image to have exposure levels varied in accordance with the present invention; and

Figures 6A-6E represent a flow diagram of a computer program useable to implement the present invention.

Modes of Carrying Out The Invention

Referring now to Figure 1, a photographic printing system according to the present invention may include a lamp house 12 for projecting light through an LCD display pad 13, a support table 15 for a negative 14, a beam splitter 16, a print lens 18 and a photosensitive medium 20 such as photographic paper.

The lamp house 12, shown in greater detail in Figure 3, comprises a conventional photographic printer type lamp house including various color lamps, which operate in conjunction with attenuator disks 64, 66, 68, as an additive color filtering means, and a shutter wheel 70 for controlling an exposure time. Other type lamp houses, such as those utilizing subtractive color filtering means, may also be used in the present invention. Negative 14 comprises a photographic transparency such as, for example, a 135mm color negative. The negative is disposed on the support table 15 which is preferably a rotatable, X-Y translatable support table such as those described in U.S. Patent Nos. 4,485,406 and 4,803,966 assigned to the assignee of the present invention, and incorporated herein by reference. However, other support tables which are well known in the art may suffice for the present

invention. As shown in Figure 3, a diffuser 72 may be located between the LCD 13 and the negative 14. Referring again to Figure 1, the lamp house 12, LCD 13, negative 14, beam splitter 16, print lens 18 and photosensitive medium 20 are each disposed on a first optical axis 24. Light from the lamphouse 12 travels along this light path and images the scene imprinted on the negative 14 onto the photosensitive medium 20.

The beam splitter 16 creates a second optical axis 26 coincident with a video camera 28 including a zoom lens 38. Therefore, the video camera may read the identical scene formed on negative 14 and eventually printed on the photosensitive medium. The video camera 28 may comprise a solid state charge coupled device (CCD) imager such as a Sony Model XC- 117 and be equipped with a zoom lens 38 capable of magnifying the image generated from the negative 14. The Chinon Corp. Model LPO36KD zoom lens will suffice for this purpose. The video camera outputs color difference signals R-Y, B-Y, and Y into the image electronics 30 which converts the signals into digital R, G, B signals. These digital signals are then inputted into computer 32 which controls the photoprinting process.

The LCD display pad 13 includes a matrix array of LCD pixels. For example, the LCD display pad used in the Kodak Data Show System has a resolution of 640 x 200 pixels within a display area of 300mm x 330mm and may be used within the present invention. The individual LCD pixels are physically between two glass plates which form the outer surfaces of the display pad and operates on conventional 110 volts A/C power at 60hz. The quality of the prints will be improved with the use of higher resolution LCD

display pads because the number of locations on the transparency corresponds to the number of pixels. Accordingly, use of the highest resolution LCD display pads available are preferred in the present invention.

The apparatus incorporating the system in accordance with the present invention contains an operator console 34, shown in Figure 5, which includes a video monitor 36 and an operator control panel 39. The video monitor 36 is interfaced with the computer 32 via the image electronics 30 such that the image read by the CCD camera 28 and processed by the image electronics 30 is displayed on video monitor 36. The operator control panel 39 may contain various user control devices (not all shown) including but not limited to a cursor direction control 40 and a cursor select button 42. These control devices are also interfaced with the computer and enable the user to control the photoprinting process by performing various functions discussed herein.

As shown in Figure 1, the image electronics 30 are interfaced with the video monitor 36 and camera 28 to convert video R-Y, B-Y and Y signals into digital R, G and B signals as well as converting operator altered digital R,G,B signals into video R,G,B signals. The image electronics 30 are also interfaced with the LCD pad 13 and computer 32 to enable the video monitor to display the exact scene, as altered by the LCD pad, which will be printed on the photosensitive paper.

In the circuitry of the image electronics 30, shown in detail in Figure 2, signals from the CCD camera (R-Y, B-Y, Y) are decoded in the decoder circuit 44 which transmits R, G, and B signals to a

logarithmic amplifier 46 which amplifies each of the three R, G, B signals into log (R, G, B) signals. These signals are further transmitted to analog to digital converter 48 which converts the data into digital R, G, and B signals. The decoder 44, logarithmic amplifiers 46 and analog to digital converter 48 comprise suitable, commercially available devices which are well known in the art. After the conversion of the signals into digital R, G, and B signals, the digital signals are then simultaneously transmitted along 2 separate signal paths.

One set of digital data is fed into a signal processing circuit to be converted into R, G, B video output signals useable by the video monitor 36 to generate a video display. This first set of digital data is transmitted from the analog to digital converter 48 into a data invert and display gamma correction RAM 50. The RAM 50 comprises appropriate means for inverting and gamma correcting the log (R,G,B) video signals which will eventually drive video display monitor 36. Many configurations of the RAM 50 which are well known to those skilled in the art. Output signals from RAM 50 are inputted into a multiplexor of pixel data or graphics data obtained from the computer, which may alter the video signals based upon the control signals obtained from operator control panel 39 including the cursor direction control 40 and cursor select button 42. The digital signals are then transmitted to a digital to analog converter 54 which converts the digital data signals into R, G, B video signals which are then transmitted to the video monitor 36. The monitor displays an image representative of the image received by the CCD camera 28 and altered in

the multi-plexor 52 by the control signals generated by the operator at the operator control panel 39. Accordingly, the video monitor may display the image as appropriately altered by the operator of the system thereby enabling the operator to decide if the chosen altered image should be printed.

The second set of digital signals from A/D converter 48 is transmitted to a paxel generator 56, processed therein and then fed into the computer 32 which calculates the proper color balancing which should be applied to the print and simultaneously displayed on the video output monitor 36.

As shown in Figure 1, the computer also controls zoom lens 38 and printing lens 18 via motor controls (not shown). A microprocessor such as Intel Corp. Model 80186 is preferably used for this purpose. The magnification of zoom lens 38 may be adjusted by the operator via control panel 39 and the desired portion of the negative can then be selected, enlarged and/or cropped and the image simultaneously displayed as such on the video monitor 36.

If the operator of the system does not wish to expose the entire image of the negative, the operator is capable of selecting a portion of the negative to be developed by manipulation of the controls on control panel 39. X-Y translatable support table 15 is adjusted, by manipulation of these controls on control panel 39, until the desired area of the negative to be developed is selected.

After selecting the area of the negative to be developed and any enlargement size, the operator may magnify the selected area to produce a developed print as desired. By using the operator controls on

the control panel 39, the operator can control the magnification of zoom lens 38. The operator can therefore select the portion of the negative to be imaged, such as one object in a scene, and magnify the selected portion by manipulation of controls on control panel 39. The computer therefore changes the aspect ratio and enlargement size on the monitor so that the selected portion is the only image printed on the photopaper.

Zoom lens 38 and print lens 18 may be operated via the control panel 39 and their configuration and operation are described in detail in U.S. Patent No. 4,809,064, assigned to the assignee of the present invention, and incorporated herein by reference. The zoom lens 38 and print lens 18 utilize control systems (not shown) described in the aforementioned patent to enable an operator of the system implementing the present invention to magnify the selected region of the transparency which will be used to expose a print. The computer 32 will, therefore, adjust magnification of zoom lens 38 based upon the control signals received from the control panel and operate print lens 18 so that the magnified portion of the transparency to be imaged, as displayed on video monitor 36, will be printed on the photosensitive medium 20.

Various systems capable of selecting the region of the transparency to be imaged and for magnifying the selected region may be used in the present invention. Such systems are disclosed in the above referenced U.S. Patent No. 4,809,064. The invention, however, is not limited to implementation with any particular system.

Referring now to Figures 4A-4C, when a negative is inserted into the system, video monitor 36

displays the image 80 from the negative which may be printed in a non-altered, non-magnified and non cropped format, as shown in Figure 4A. However, by manipulation of the controls on the control panel 39 the image can be magnified as shown at 80' in Figure 4B. Also, by operating the cursor direction control 40 and curser select button 42 on the control panel 38, the portion 82 of the image to be altered may be defined as shown in Figure 4B. The image portion desired to be printed may be further magnified as shown in Figure 4C. The zoom lens 38 and print lens 18 are adjusted to allow the video monitor 36 to display the image 80'' which is desired to be exposed on the print. Alternatively, the image may first be magnified as in Figure 4C and subsequently the area to be altered defined in the magnified image (not shown).

Vignetting and/or the amount of dodging or burning within the defined portion of the image 82 can now be adjusted by the operator by manipulation of the controls on the control panel 39 until the desired or properly contrast balanced exposure for the image to be printed is obtained and displayed on the video monitor 36. The computer 32 may store, in memory, various vignette symbols such as a heart, a star, a circle, etc. The operator may select a vignette symbol to have the image exposed thereon by selecting a symbol which, for example, may appear on a menu on the monitor 36. The vignette symbol is then created by computer activation of selected pixels of the LCD pad and appears on the monitor. In this situation, the portion of the negative outside of the vignetting symbol will be exposed of a low to nonexistent level. At this time, the user may activate a switch on the control panel 39 and

the print will be exposed. The computer will control the activation of the pixels of the LCD pad so that a properly exposed print is developed. Specific locations on the photosensitive medium which are to be lightened relative to other locations will have the corresponding pixels of the LCD pad, which allow light to be transmitted to those locations, activated for a relatively longer period of time to decrease the exposure time at those locations.

Exposure of the print will now be described in conjunction with the flow diagram of Figures 6A-6E.

Numeric references refer to steps of the program as shown in the flow diagram. The system is first initialized in its initial step 102. When a film negative is inserted, the system accepts a film negative and moves the film into position in the following step 104. In the next step 106, the shutter and attenuator wheels are set, the computer directs the scanner to scan the negative and adjusts the attenuator wheels, the image is displayed on the monitor and a menu is displayed. The operator would then choose the desired format from the menu. In the resulting step 108, the computer would adjust the lenses to change the aspect ratio and enlargement size of the image as displayed on the monitor. The aforementioned steps, outlined by a dotted line forming a box 110, are well known in the art and used in conventional photoprinting systems.

The computer loads the menu in a subsequent step 112 and, as shown in the next step 114, the system will display a menu asking the operator if he or she wishes to vignette. If the operator chooses the vignette menu, in the next step 116, a menu displaying the types of vignette available is

displayed. The operator will then choose the desired vignette symbol and, in the next step 118, the computer loads the chosen vignette pattern and the LCD's activate in a corresponding pattern. The vignetted image is displayed on the monitor. In the following step 120, the operator can move the entire vignette position and enlarge or shrink the vignette by manipulation of controls on the control panel. The operator may then choose the polarity of the vignette to be white or black in the next step 122. If the white polarity is chosen, the computer then, in the following step 124, activates the LCD pixels corresponding to the outside of the vignette area of the image to increase the exposure within the vignette area. The operator can also choose the density level of the vignette resulting in either a "soft" or "hard" vignette. In the printing step 126, the vignetted print is created.

If, in step 122, the operator chooses the black polarity, in subsequent steps 128-132, the computer activates the LCD pixels corresponding to the area within the vignette, thereby darkening the portion of the image outside the vignette.

If in step 114, the operator does not choose the vignette menu, the computer will display a graphic menu for burn-in or dodging in the subsequent step 134. The computer then creates a blinking cursor on the monitor and the operator selects the area to be burned-in or dodged by moving the cursor to locations on the monitor and double clicking the select button as indicated in subsequent steps 138, 140, 142, 144. In the next step 146, the operator can select the density for outside or inside the defined area by lightening or darkening the area via the control panel. The

computer adjusts the exposure by controlling the LCD pixels. By varying the activation levels of the pixel and/or activating various pixels the image is burned or dodged.

After the dodged or burned-in image has been selected the computer, in the next step 145, calculates the correct exposure and printing times. The computer will then begin the printing and exposure process by varying the exposure on the photosensitive paper via the LCD pixels. In subsequent steps 146-158, the computer will effectuate the printing changes by blackening pixels either within or without the boundary area to achieve the desired print.

Defining of the portion of the image to have exposure levels varied by the LCD pad, as indicated in steps 138-144 of the flow diagram, may be accomplished by using a digitizing means as shown in Figure 5. The image is displayed on the video monitor 36. By manipulating the cursor direction control 40, the operator can move the cursor to a variety of positions on the image. The portion of the image is defined by depressing the cursor select button 42 to digitize a series of points 101 on the image which define the portions of the image 102 which have exposure levels varied by the operator using the LCD pad.

While the invention has been described with respect to the embodiment depicted herein, it will be apparent to one skilled in the art that various modifications may be made to the systems depicted herein. Accordingly, it will be appreciated that the invention is not limited to the particular embodiments and details depicted herein. Various modifications, changes, variations, substitutions

and equivalents may be utilized by one skilled in the art without departing in any way from the spirit and scope of the invention as defined by the following claims.

Claims:

1. A method of regionally varying the exposure of an image onto a photosensitive medium comprising:

projecting light through an LCD display pad and a phototransparency to project an image onto said photosensitive medium, said LCD pad having a matrix array of LCD pixels therein;

defining a portion of the image to have exposure levels on the photosensitive medium varied by the LCD display pad relative to an undefined portion of the image;

selectively activating pixels within the LCD display pad enabling the areas within the defined portion of the image to be exposed at a different level than areas within the undefined portion of the image thereby resulting in a regionally variant exposure of an image on the photosensitive medium.

2. The method of regionally varying the exposure of an image onto a photosensitive medium according to claim 1 further comprising displaying the projected image on a video display monitor.

3. The method of regionally varying the exposure of an image onto a photosensitive medium according to claim 2 further comprising selecting the region of the transparency to be imaged wherein the defined portion of the image is within the selected region of the transparency.

4. The method of regionally varying the exposure of an image onto a photosensitive medium according to claim 3 further comprising magnifying the selected region of the transparency thereby enabling the defined portion of the image to be a magnified part of phototransparency.

5. The method of regionally varying the

exposure of an image according to claim 1 or 4 wherein the LCD pixels within the defined area are selectively activated to decrease the exposure time of the defined area to the photosensitive medium.

6. The method of regionally varying the exposure of an image according to claim 5 wherein pixels outside of the defined area are selectively activated to decrease the exposure time of the undefined area to the photosensitive medium.

7. The method of regionally varying the exposure of an image according to claim 1 or 4 further comprising selecting a predetermined pattern to define the portion of the image.

8. The method of regionally varying the exposure of an image according to claim 2 further comprising defining a portion of the image by outlining an area on the video display monitor which displays the projected image.

9. The method of regionally varying the exposure of an image according to claim 2 wherein light is projected first through the LCD pad and then through the phototransparency.

10. An apparatus for regionally varying the exposure of an image onto a photosensitive medium comprising:

an LCD display pad having a matrix array of pixels therein;

means for projecting light through the LCD display pad and through a phototransparency to project an image onto a photosensitive medium;

means for defining a portion of the image which will have exposure levels onto the photosensitive medium varied relative to an undefined portion of the image; and

means for selectively activating pixels to

regionally vary the exposure levels of the image, said means being operatively interfaced to the LCD display pad and to the means for defining a portion of the image.

11. The apparatus for regionally varying the exposure of an image onto a photosensitive medium according to claim 10 further comprising a video display monitor operatively interfaced to receive a signal representative of the projected image thereby being capable of displaying the image.

12. The apparatus for regionally varying the exposure of an image onto a photosensitive medium according to claim 11 further comprising a means for selecting a region of a transparency to be projected, said means and the means for projecting an image of a transparency being operatively interfaced thereby enabling the means for projecting an image to project only a selected region of the transparency.

13. The apparatus for regionally varying the exposure of an image onto a photosensitive medium according to claim 12 further comprising a means for magnifying a selected region of a transparency, said means being aligned with the light path generated by the means for projecting the image.

14. The apparatus for regionally varying the exposure of an image onto a photosensitive medium according to claim 13 wherein the means for magnifying a selected region of the transparency comprises a zoom lens.

15. The apparatus for regionally varying the exposure of an image onto a photosensitive medium according to claim 14 further comprising a beam splitter oriented within the light path generated by the means for projecting an image for creating two

identical images.

16. The apparatus for regionally varying the exposure of an image onto a photosensitive medium according to claim 15 further comprising a camera for enabling an image from the beam splitter to be displayed on the video display monitor.

17. The apparatus for regionally varying the exposure of an image onto a photosensitive medium according to claim 16 wherein the camera comprises a CCD camera.

18. The apparatus for regionally varying the exposure of an image onto a photosensitive medium according to claim 17 wherein the means for selectively activating pixels comprises an exposure control circuit interfaced with the CCD camera, video display and LCD display pad.

19. The apparatus for regionally varying the exposure of an image onto a photosensitive medium according to claim 18 wherein the means for selectively activating pixels comprises an exposure control computer within the exposure control circuit.

20. The apparatus for regionally varying the exposure of an image onto a photosensitive medium according to claim 19 wherein the means for defining a portion of the image further comprises a digitizing means capable of designating an outline of an area of the image generated from the transparency.

21. The apparatus for regionally varying the exposure of an image onto a photosensitive medium according to claim 20 further comprising a print lens within the light path generated by the means for projecting an image.

22. The apparatus for regionally varying the

exposure of an image onto a photosensitive medium according to claim 21 wherein said means for projecting an image of a phototransparency onto a photosensitive medium comprises:

a lamp house;

a transparency support means; and

means for supplying a photosensitive medium oriented with respect to the transparency support means and lamp house to allow a light path generated by the lamp house to coincide with a transparency on the support means thereby enabling an image to be projected onto the photosensitive medium.

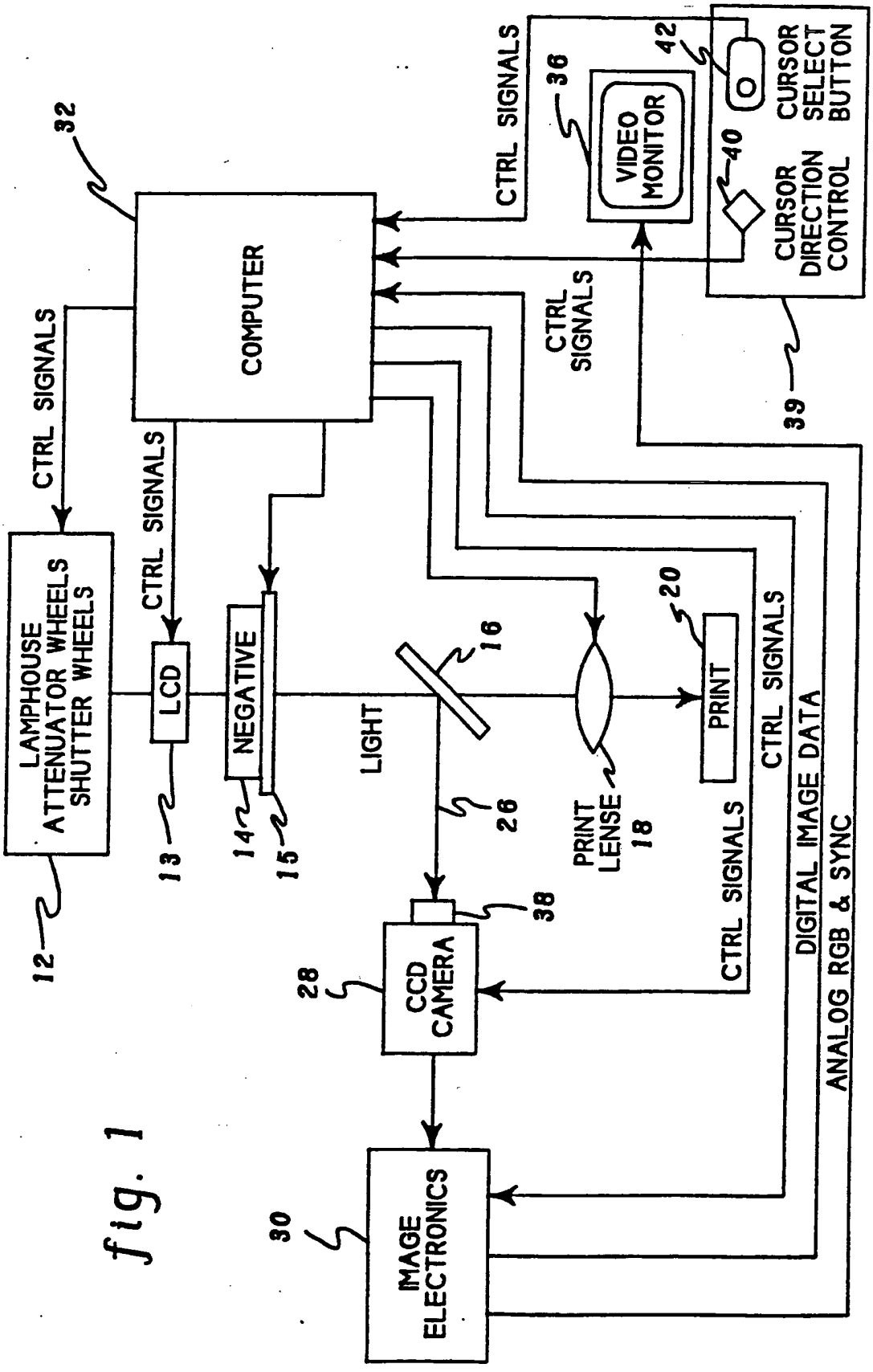
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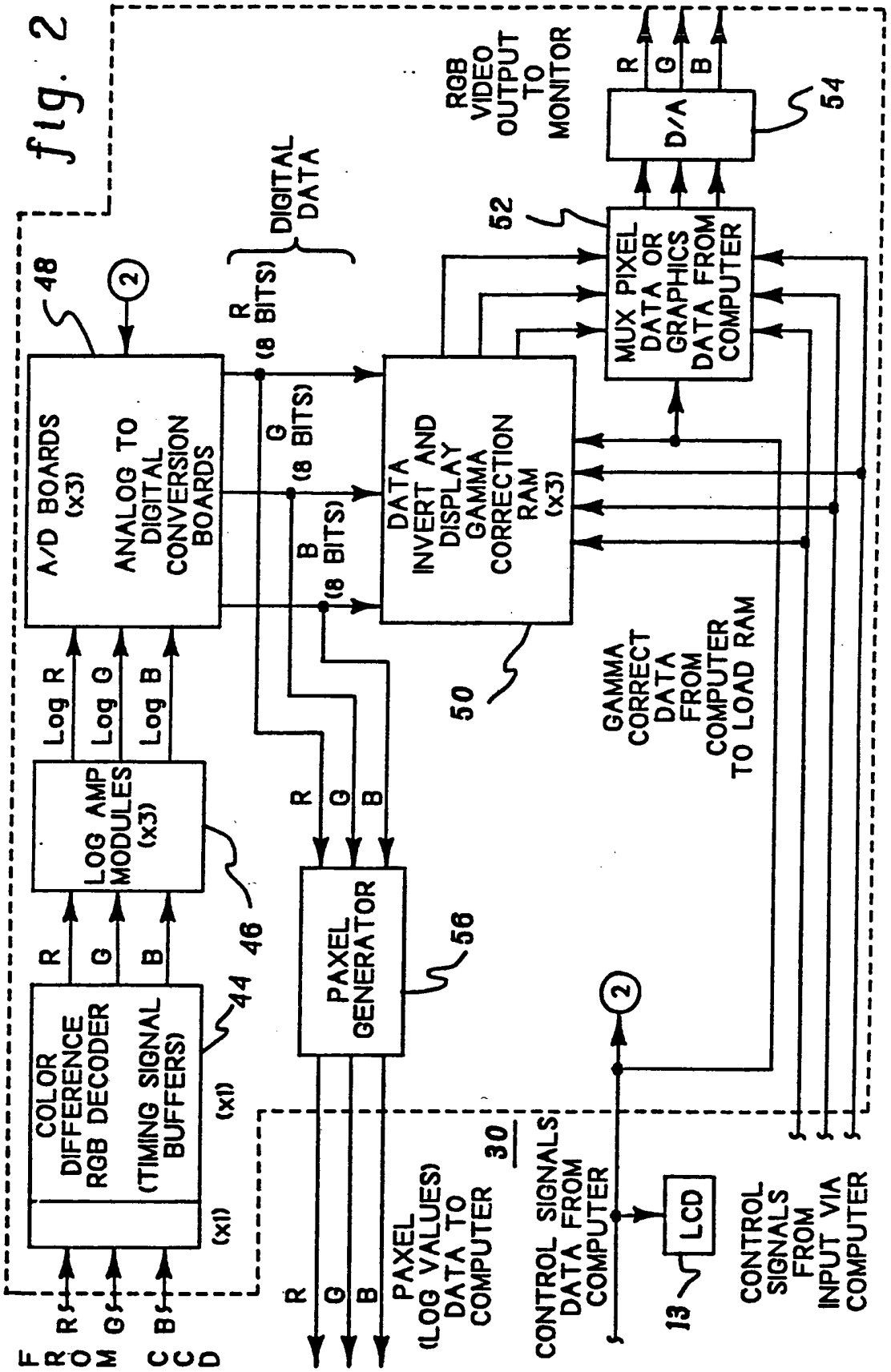
fig. 1

fig. 2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B (8 BITS)
DIGITAL DATA
DATA INVERT AND DISPLAY GAMMA CORRECTION RAM (x3)
50
MUX PIXEL DATA OR GRAPHICS DATA FROM COMPUTER
52
D/A
54
RGB VIDEO OUTPUT TO MONITOR
GAMMA CORRECT DATA FROM COMPUTER TO LOAD RAM
PAXEL GENERATOR
56
PAXEL (LOG VALUES) DATA TO COMPUTER
30
CONTROL SIGNALS DATA FROM COMPUTER
LCD
13
CONTROL SIGNALS FROM INPUT VIA COMPUTER

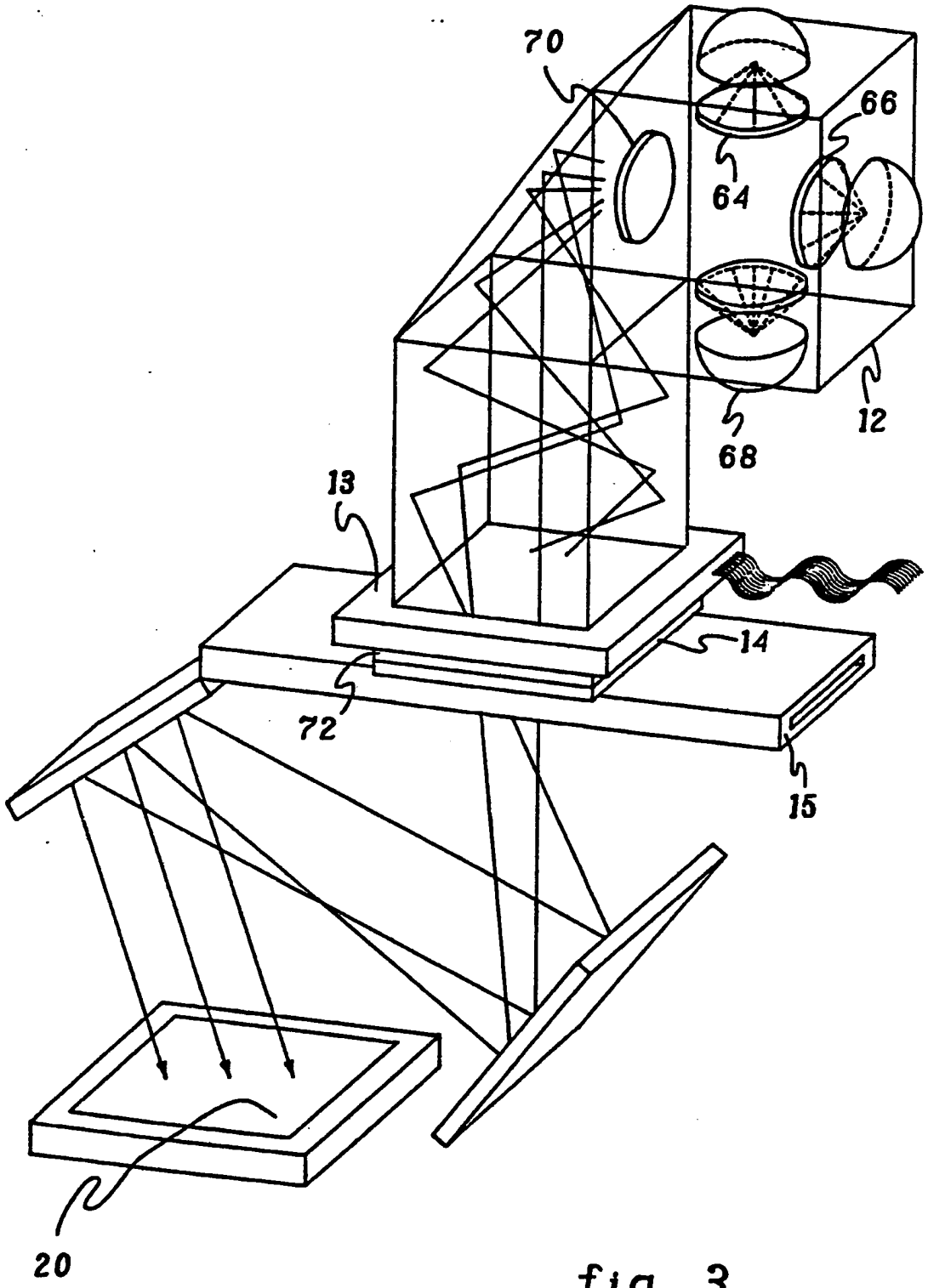


fig. 3

fig. 4A

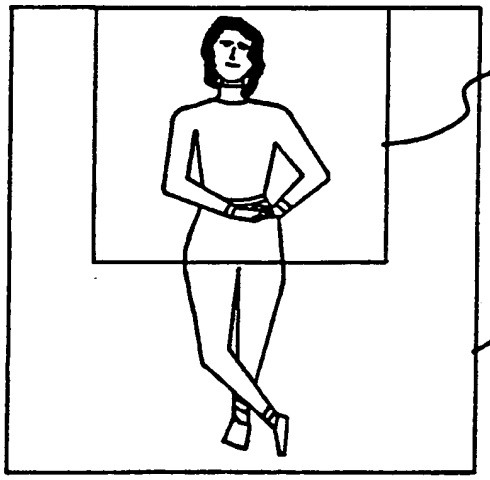


fig. 4B

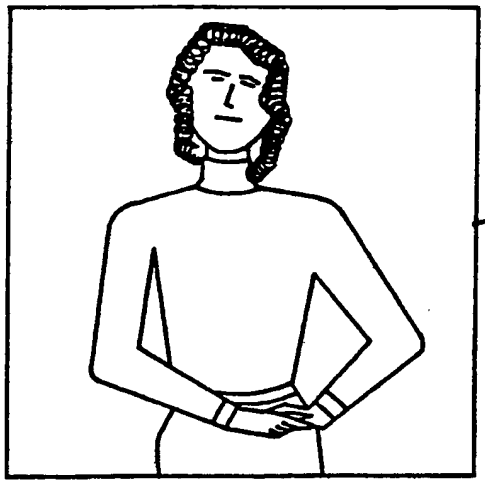


fig. 4C

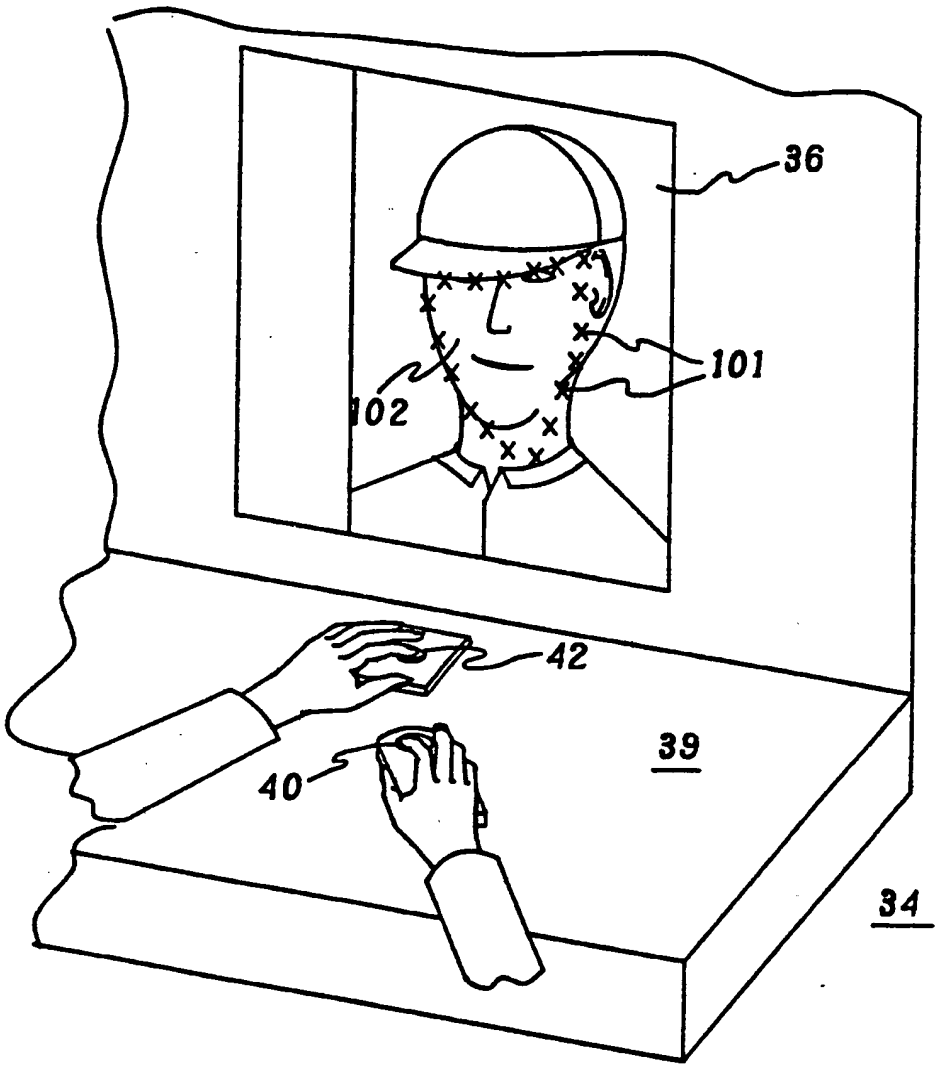


fig. 5

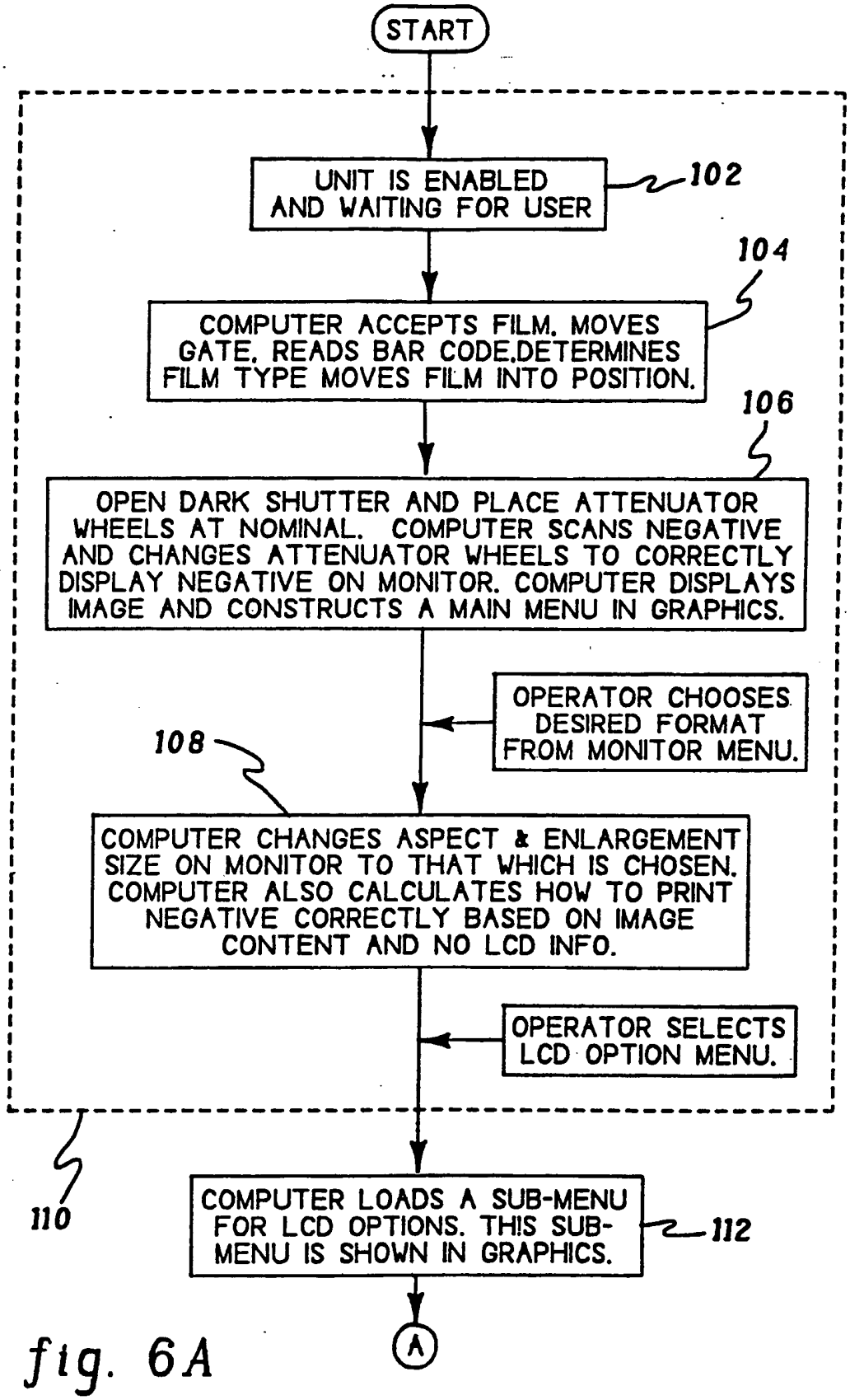

START
UNIT IS ENABLED AND WAITING FOR USER
102
104
COMPUTER ACCEPTS FILM, MOVES GATE, READS BAR CODE.DETERMINES FILM TYPE MOVES FILM INTO POSITION.
106
OPEN DARK SHUTTER AND PLACE ATTENUATOR WHEELS AT NOMINAL. COMPUTER SCANS NEGATIVE AND CHANGES ATTENUATOR WHEELS TO CORRECTLY DISPLAY NEGATIVE ON MONITOR. COMPUTER DISPLAYS IMAGE AND CONSTRUCTS A MAIN MENU IN GRAPHICS.
OPERATOR CHOOSES DESIRED FORMAT FROM MONITOR MENU.
108
COMPUTER CHANGES ASPECT & ENLARGEMENT SIZE ON MONITOR TO THAT WHICH IS CHOSEN. COMPUTER ALSO CALCULATES HOW TO PRINT NEGATIVE CORRECTLY BASED ON IMAGE CONTENT AND NO LCD INFO.
OPERATOR SELECTS LCD OPTION MENU.
110
COMPUTER LOADS A SUB-MENU FOR LCD OPTIONS. THIS SUB-MENU IS SHOWN IN GRAPHICS.
112
A

fig. 6A

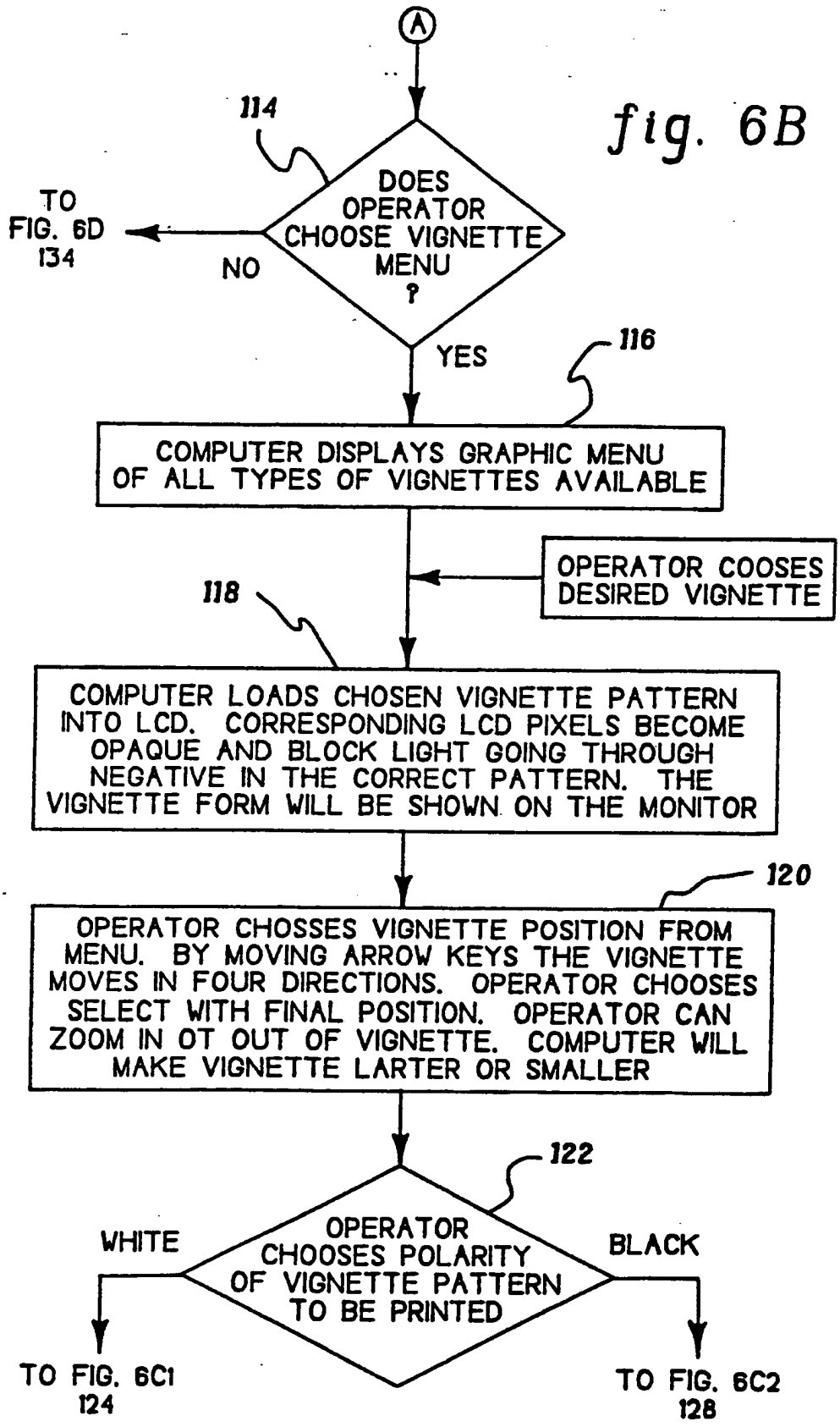

A
114
DOES OPERATOR CHOOSE VIGNETTE MENU ?
TO FIG. 6D 134
NO
YES
116
COMPUTER DISPLAYS GRAPHIC MENU OF ALL TYPES OF VIGNETTES AVAILABLE
OPERATOR COOSES DESIRED VIGNETTE
118
COMPUTER LOADS CHOSEN VIGNETTE PATTERN INTO LCD. CORRESPONDING LCD PIXELS BECOME OPAQUE AND BLOCK LIGHT GOING THROUGH NEGATIVE IN THE CORRECT PATTERN. THE VIGNETTE FORM WILL BE SHOWN ON THE MONITOR
120
OPERATOR CHOSSES VIGNETTE POSITION FROM MENU. BY MOVING ARROW KEYS THE VIGNETTE MOVES IN FOUR DIRECTIONS. OPERATOR CHOOSES SELECT WITH FINAL POSITION. OPERATOR CAN ZOOM IN OT OUT OF VIGNETTE. COMPUTER WILL MAKE VIGNETTE LARTER OR SMALLER
122
OPERATOR CHOOSES POLARITY OF VIGNETTE PATTERN TO BE PRINTED
WHITE
BLACK
TO FIG. 6C1 124
TO FIG. 6C2 128

fig. 6B

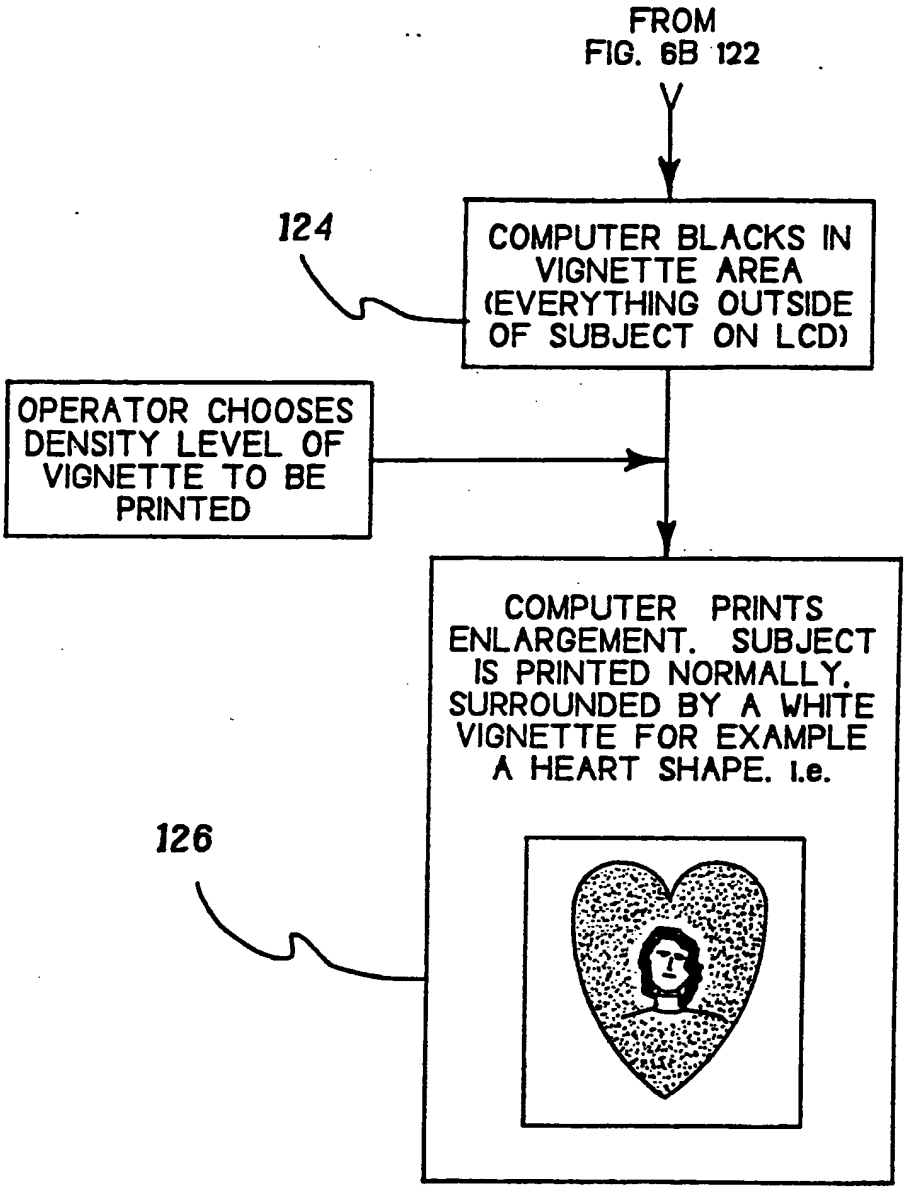

FROM
FIG. 6B 122
124
COMPUTER BLACKS IN VIGNETTE AREA (EVERYTHING OUTSIDE OF SUBJECT ON LCD)
OPERATOR CHOOSES DENSITY LEVEL OF VIGNETTE TO BE PRINTED
COMPUTER PRINTS ENLARGEMENT. SUBJECT IS PRINTED NORMALLY, SURROUNDED BY A WHITE VIGNETTE FOR EXAMPLE A HEART SHAPE. i.e.
126

fig. 6C1

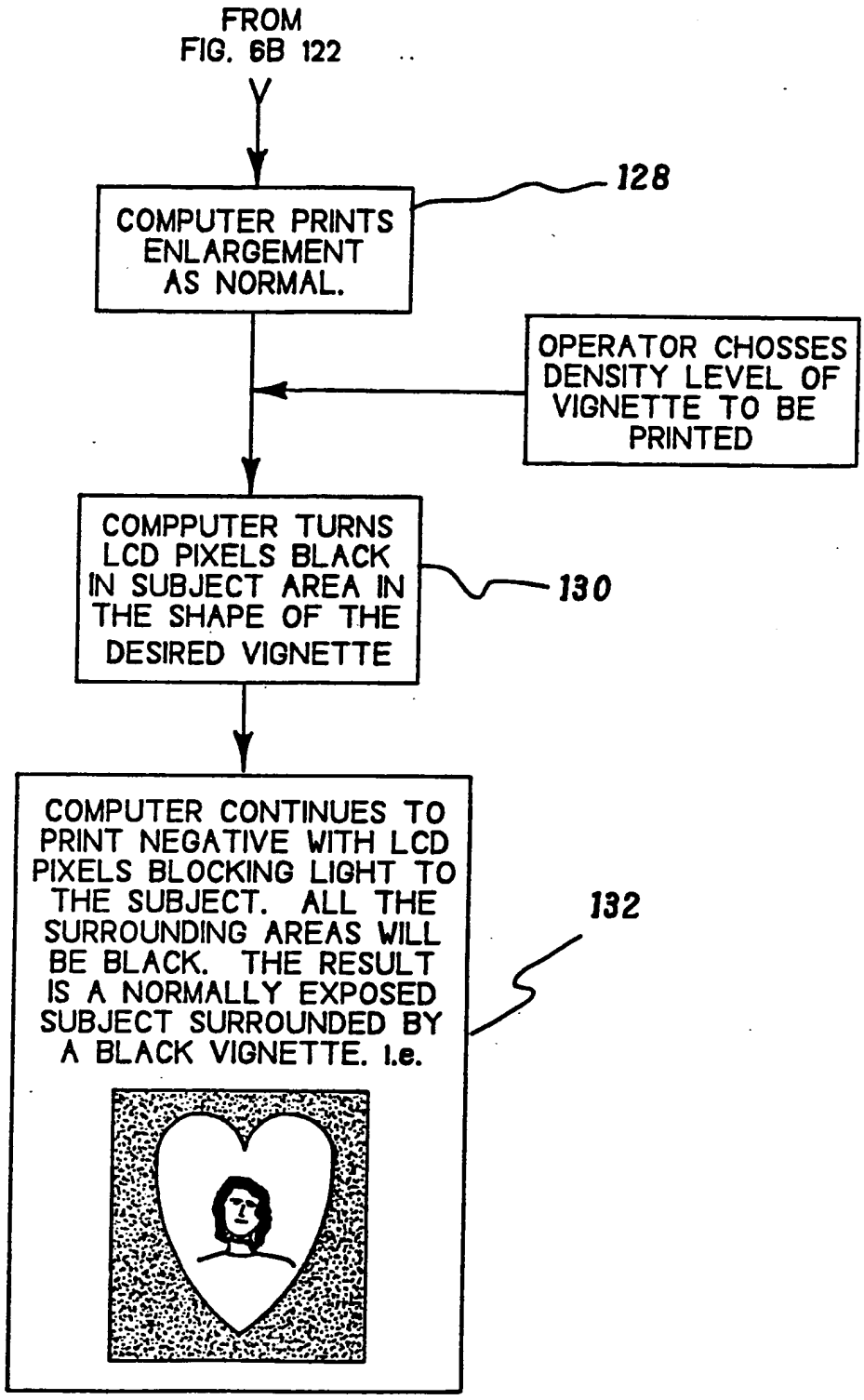

FROM FIG. 6B 122
COMPUTER PRINTS ENLARGEMENT AS NORMAL.
128
OPERATOR CHOSSES DENSITY LEVEL OF VIGNETTE TO BE PRINTED
COMPPUTER TURNS LCD PIXELS BLACK IN SUBJECT AREA IN THE SHAPE OF THE DESIRED VIGNETTE
130
COMPUTER CONTINUES TO PRINT NEGATIVE WITH LCD PIXELS BLOCKING LIGHT TO THE SUBJECT. ALL THE SURROUNDING AREAS WILL BE BLACK. THE RESULT IS A NORMALLY EXPOSED SUBJECT SURROUNDED BY A BLACK VIGNETTE. i.e.
132

fig. 6C2

fig. 6D

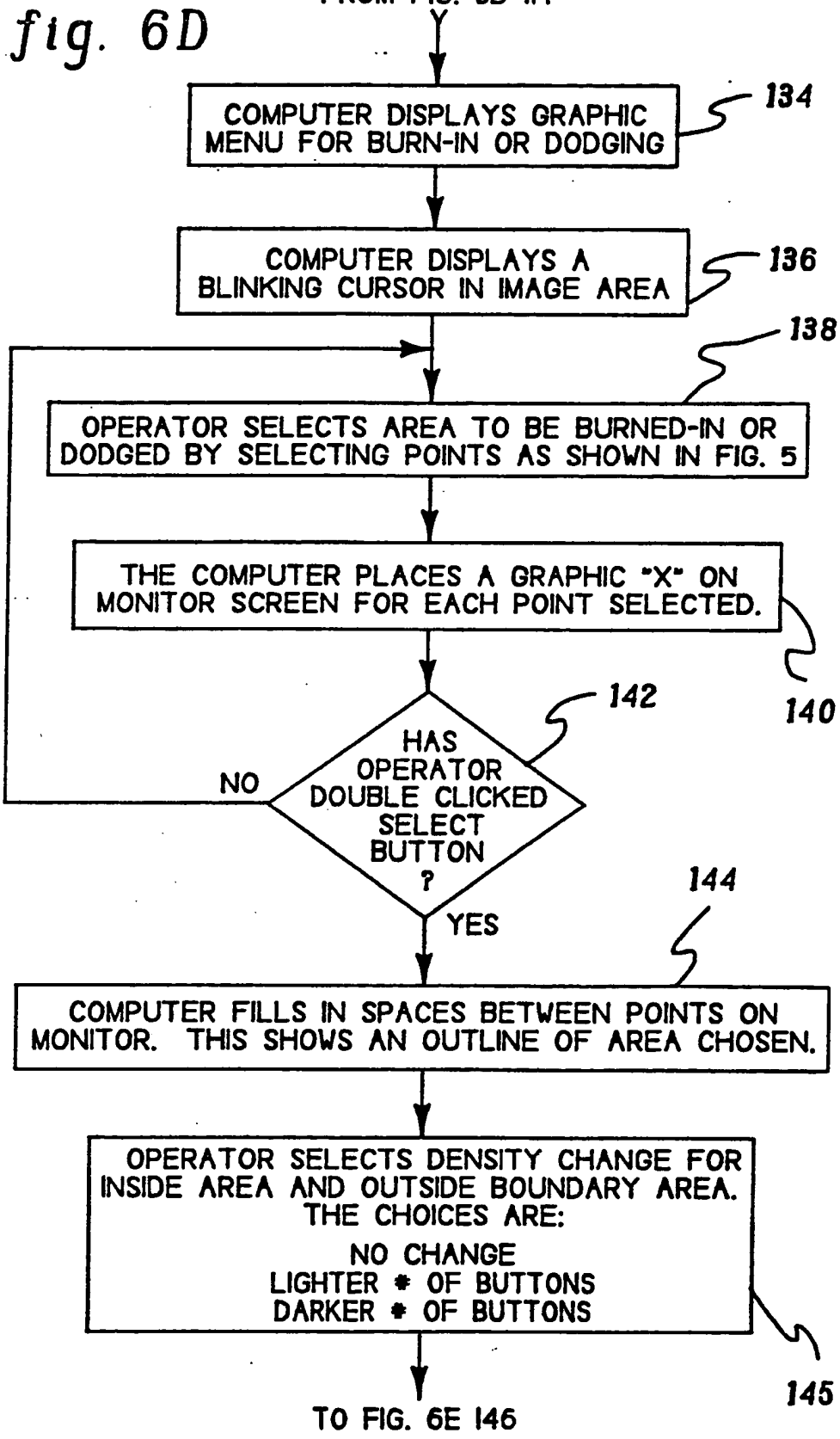
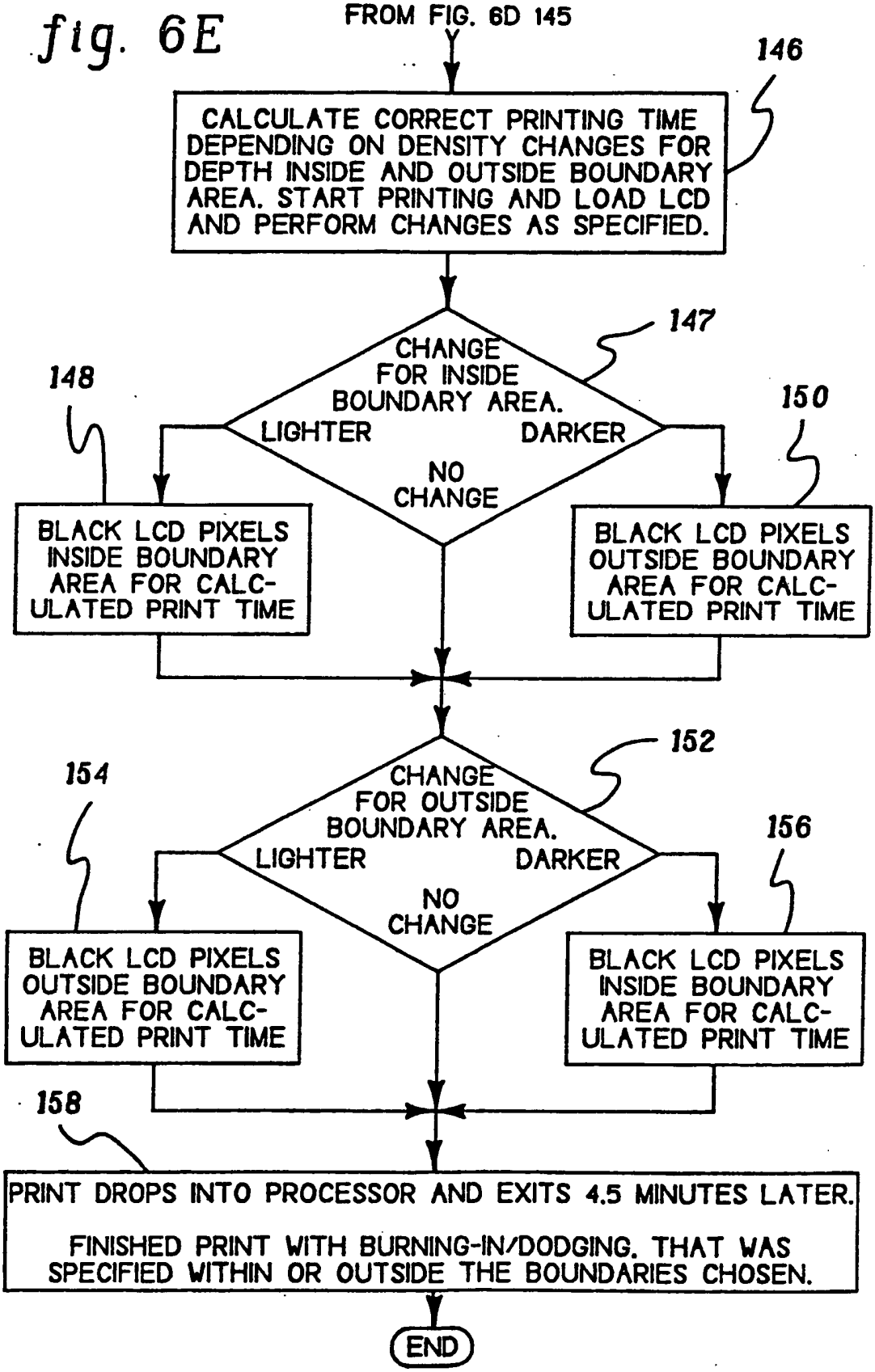

FROM FIG. 6B 114
COMPUTER DISPLAYS GRAPHIC MENU FOR BURN-IN OR DODGING
134
COMPUTER DISPLAYS A BLINKING CURSOR IN IMAGE AREA
136
138
OPERATOR SELECTS AREA TO BE BURNED-IN OR DODGED BY SELECTING POINTS AS SHOWN IN FIG. 5
THE COMPUTER PLACES A GRAPHIC "X" ON MONITOR SCREEN FOR EACH POINT SELECTED.
140
142
HAS OPERATOR DOUBLE CLICKED SELECT BUTTON ?
NO
YES
144
COMPUTER FILLS IN SPACES BETWEEN POINTS ON MONITOR. THIS SHOWS AN OUTLINE OF AREA CHOSEN.
OPERATOR SELECTS DENSITY CHANGE FOR INSIDE AREA AND OUTSIDE BOUNDARY AREA. THE CHOICES ARE:
NO CHANGE
LIGHTER # OF BUTTONS
DARKER # OF BUTTONS
145
TO FIG. 6E 146

fig. 6E


FROM FIG. 6D 145
146
CALCULATE CORRECT PRINTING TIME DEPENDING ON DENSITY CHANGES FOR DEPTH INSIDE AND OUTSIDE BOUNDARY AREA. START PRINTING AND LOAD LCD AND PERFORM CHANGES AS SPECIFIED.
147
CHANGE FOR INSIDE BOUNDARY AREA.
LIGHTER
DARKER
NO CHANGE
148
150
BLACK LCD PIXELS INSIDE BOUNDARY AREA FOR CALC-ULATED PRINT TIME
BLACK LCD PIXELS OUTSIDE BOUNDARY AREA FOR CALC-ULATED PRINT TIME
152
CHANGE FOR OUTSIDE BOUNDARY AREA.
LIGHTER
DARKER
NO CHANGE
154
156
BLACK LCD PIXELS OUTSIDE BOUNDARY AREA FOR CALC-ULATED PRINT TIME
BLACK LCD PIXELS INSIDE BOUNDARY AREA FOR CALC-ULATED PRINT TIME
158
PRINT DROPS INTO PROCESSOR AND EXITS 4.5 MINUTES LATER.
FINISHED PRINT WITH BURNING-IN/DODGING. THAT WAS SPECIFIED WITHIN OR OUTSIDE THE BOUNDARIES CHOSEN.
END

INTERNATIONAL SEARCH REPORT

International Application No PCT/US 91/09252

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[5]: G 03 B 27/28,G 03 B 15/06

II. FIELDS SEARCHED

Minimum Documentation Searched

Classification System	Classification Symbols
IPC[5]	G 03 B 27/00,G 03 B 15/00

Documentation Searched other than Minimum Documentation to the Extent that such Documents are included in the Fields Searched

III. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
P,X	DE, A1, 3 933 862 (BKE) 18 April 1991 (18.04.91), see fig.; column 1, line 57 - column 2, line 38.	1,10
P,A	see totality.	2,3,5-9,11,12
A	US, A, 4 809 064 (AMOS) 28 February 1989 (28.02.89), see fig. 1; abstract; column 6, lines 8-31 (cited in the application).	1-4,8,10-22
A	US, A, 3 728 481 (FROEHLICH) 17 April 1973 (17.04.73), see fig. 1,1A,2; abstract; claims.	1-8,10-13

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
26 March 1992	07 APR 1992
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	Mme N. KUIPER

International Application No PCT/US 91/09252

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, ** with indication, where appropriate, of the relevant passages	Relevant to Claim No.
A	US, A, 4 603 966 (BROWNSTEIN) 05 August 1986 (05.08.86), see fig.; abstract; column 1, lines 39-43.	1-4,7, 8,10-14

ANHANG

zum internationalen Recherchenbericht über die internationale Patentanmeldung Nr.

ANNEX

to the International Search Report to the International Patent Application No.

ANNEXE

au rapport de recherche international relatif á la demande de brevet international n°

PCT/US91/09252 SAE 55209

In diesem Anhang sind die Mitglieder der Patentfamilien der im obengenannten internationalen Recherchenbericht angeführten Patentdokumente angegeben. Diese Angaben dienen nur zur Unterrichtung und erfolgen ohne Gewähr.

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The Office is in no way liable for these particulars which are given merely for the purpose of information.

La présente annexe indique les membres de la famille de brevets relatifs aux documents de brevets cités dans le rapport de recherche international visée ci-dessus. Les renseignements fournis sont donnés á titre indicatif et n'engagent pas la responsibilité de l'Office.

In Recherchenbericht angeführtes Patentdokument Patent document cited in search report Document de brevet cité dans le rapport de recherche	Datum der Veröffentlichung Publication date Date de publication	Mitglied(er) der Patentfamilie Patent family member(s) Membre(s) de la famille de brevets	Datum der Veröffentlichung Publication date Date de publication
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